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CHAPTER 12.0 SYNTHESIS OF FINDINGS ON EFFECTS OF STAFFING ON QUALITY OF CARE¹

12.1 Introduction

The analyses reported in Chapters 9, 10, and 11 of this report used different samples and different quality measures to examine relationships between staffing and quality of care. Given the heterogeneity of the nursing home population that includes both post-acute Medicare patients requiring skilled care for medical/nursing conditions as well as long-term residents requiring daily assistance and chronic care, the use of different samples and quality measures was appropriate. However, a synthesis of this information is required for application to policy.

This chapter draws on the analyses of the preceding chapters to address the following four questions:

1. Do nurse staffing ratios exist below which the likelihood of poor quality care is substantially increased?
2. Do these analyses suggest certain levels that on average may be important to achieve?
3. What attributes of case mix are important to take into consideration in determining staffing levels?
4. How might case mix be taken into consideration when applying staffing requirements?

The chapter is organized around the responses to these four questions.

12.2 Do Nurse Staffing Ratios Exist Below Which the Likelihood of Poor Quality Care Is Substantially Increased?

We found associations between low staffing levels and the likelihood of quality problems across an array of measures for different types of staff. Table 12.1 shows which staff types were significantly associated with each quality measure. These associations consisted of an identified staffing level below which facilities were significantly more likely to have quality of care problems, after adjusting for case mix characteristics. In the first column, the quality measures are grouped by those relating to hospitalization of new admissions (Chapter 9), and those pertaining to long-term nursing home residents (Chapters 10 and 11), which include some quality of life measures.

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We include results pertaining to RN staff, RN and LPN staff combined (licensed staff), and nurse's aide staff in this table and in future discussions for several reasons. First, federal requirements currently exist for these three staff categories. Second, our analyses demonstrated that for some quality measures (e.g., hygiene/grooming), LPN staff did not substitute for RN staff, thus requiring a separate measure for RNs alone. This reflects the different roles of RNs and LPNs in nursing homes, where the former play a greater role in supervising and training nurse's aide staff and provision of selected skilled services. Third, for other quality measures, combined RN and LPN staff levels were associated with improved quality independent of whether staff were RNs or LPNs. Combined RN and LPN staff levels recognize that LPNs and RNs are substitutable in these situations, but don't require a specific ratio of LPNs. Fourth, nurse's aide staffing levels were frequently associated with quality independently of the other types of staff. Fifth, a total staff requirement was not examined because such a requirement mixes different levels of skill and inappropriately allows complete substitution of one staff type for another (e.g., nurse's aide time for RN time).

Table 12.1 Types of staffing found to be associated with different quality measures

<u>Quality Measure</u>	<u>RN</u>	<u>Licensed Staff (RN + LPN)</u>	<u>Aide</u>
Admission Sample			
CHF hospitalizations		X	X
Electrolyte imbalance hospitalizations	X	X	X
Respiratory infection hospitalizations	X	X	X
UTI hospitalizations	X	X	X
Sepsis hospitalizations	X	X	X
\$1, 2, or 3 hospitalization measures	X	X	X
Long-Stay Sample			
Pressure ulcer incidence	X	X	X
Functional improvement	X	X	
Resisting care improvement	X	X	
Significant weight loss		X	X
Unclean and/or ungroomed	X		

While the basis for some of the associations seem intuitive, others require explication. Infections, for example, are the major cause of hospital transfer for nursing home residents, whether respiratory, urinary tract, or sepsis -- a life-threatening, blood-borne infection. The role of nurse's aides is critical in preventing pneumonia, by preventing aspiration in individuals with difficulty swallowing through proper positioning and feeding, keeping individuals warm and dry, and reducing the spread of contagious infections through proper infection precautions. RN & LPN staff play a critical role in early identification of infections, enforcing precautions to prevent infections from spreading throughout the facility, and making sure that treatment is initiated so that sepsis does not result. Staff who are well trained and supervised by adequate RN staffing are more likely to identify early symptoms of infections such as confusion, agitation, or non-specific complaints. Thus, all three types of staff have an important

role in preventing hospitalization for infections. Their role in preventing hospitalizations for other problems is described further in Chapter 9.

Some of the associations between quality measures pertinent to long-term nursing home residents and staffing levels also require further explanation. Pressure ulcer incidence was related to all three types of staffing, reflecting the labor-intensive care that is required to prevent pressure ulcers. Nurse's aides turn immobilized residents and manage incontinence, while RN staff supervise nurse's aides, and both RN and LPN staff assess pressure ulcer risk and skin condition. However, for functional improvement, resisting care, and hygiene/grooming, we found relationships only with RN and/or combined RN and LPN staff. RNs could certainly improve the likelihood that patients will recover from functional disability, resist care less, and be appropriately cleaned and groomed through their nurse's aide supervisory and training role. Higher RN staff levels would mean greater observation on the floor and oversight of the care provided by nurse's aides in these areas that require attentive nurse's aide staff. Patience and skill are required to work with residents who are resistant to care, and to help residents participate in personal care activities, rather than simply doing tasks for them.

We anticipated that these measures would relate closely to nurse's aide staffing levels as well as RN staffing, but that was not always the case. One reason that a relationship between nurse's aide staffing and these quality measures was not always found might be that the accuracy of Medicaid cost report nurse's aide staffing data was far worse than RN cost report data. As indicated in Chapter 8, the correlation between Medicaid cost report data and payroll data was only 0.39 for nurse's aide staffing, while it was 0.73 for RN staffing. Thus, random error in the staffing variable could obscure relationships with quality. A second issue is that nurse's aide staffing levels may not be the most critical factor affecting quality; nurse's aide staff turnover, training, or allocation among shifts may be more important considerations. These factors could influence the amount of time nurse's aides spend on individual residents and their ability to overcome difficulties encountered in providing care, but assessing the importance of these measures was beyond the scope of this analysis.

Results differed among states to some extent, probably reflecting differences in data quality, coding conventions, and the state environments in which nursing home care is provided. Nevertheless, the evidence strongly supports the existence of relationships between staffing and quality across an array of quality measures for different types of nursing home residents. These relationships are generally consistent and in the expected direction after taking case mix and selected facility characteristics into consideration.

12.3 Do These Analyses Suggest Certain Levels That on Average May Be Important to Achieve?

Not only did the analyses yield relatively pervasive associations between staffing and quality, but the staffing levels (or thresholds) associated with substantial improvements in quality were relatively

consistent across the analyses. As described in the previous chapters, we tested several different staffing levels, including some that were defined based upon the staffing distributions (e.g., the lowest decile) and others that were empirically derived using a method for grouping facilities in order to maximize group differences. While generally we examined staffing levels that predicted whether facilities would fall in the worst quality decile, we also examined other quality levels. We used multivariate methods to adjust for characteristics that would influence staffing and quality of care. Thus, the staffing levels presented here represent a synthesis of multiple analyses across different quality measures in our three study states.

While the focus of the project was to identify staffing levels that might be used as minimum standards, our analyses suggested that minimum levels reduced the likelihood of quality problems in several areas, but higher “preferred minimum” levels existed above which quality was improved across the board. These minimum and preferred minimum levels that were obtained from the three prior chapters are presented in the first column of Table 12.2. (The levels for RN exclude Director of Nursing (DON) hours.) A nurse’s aide staffing level below about 2.0 hours per resident day was associated with higher rates of hospitalization for infections and other potentially avoidable causes of hospitalization, higher pressure ulcer incidence rates, and higher rates of significant weight loss. Although we did not test all levels of nurse’s aide staffing levels, this level of 2.0 hours was most strongly associated with a quality difference across the range of measures. Thus it is proposed as both the minimum and preferred minimum level. For RN and LPN staff, facilities below 0.75 hours per resident day had a substantially higher risk of quality problems related to hospitalization. For long-stay residents, however, staffing levels below 0.9 and 1.0 were associated with greater risk of problems with pressure ulcer incidence, resisting care, lack of functional improvement, and significant weight loss. Thus, we suggest a preferred minimum staffing level of 1.0 hours per resident day. Generally, 0.2 hours per resident day of RN time was sufficient to avoid the worst decile for most quality measures. The one measure that was substantially higher than this was RN time for increased risk of unclean and ungroomed residents, which was 0.49. The analysis for this quality measure included the Director of Nursing in the staffing level, which inflated the RN staffing level marginally. Thus we suggest 0.45 for the preferred minimum level.

Using the national distribution of facilities described in Chapter 3, we provide the percentage of facilities that fall below these minimum and preferred minimum staffing levels and the percentage of facilities that fall more than 10%, 20%, and 30% below these staffing levels (Table 12.2). While 54% of facilities have less than 2.0 hours per resident day of nurse’s aide time, 37% of facilities are more than 10% below this level (1.8 or less), 24% of facilities are more than 20% below this level (1.6 or less), and 14% of facilities are more than 30% below this level

(1.4 or less). Thus, of facilities that fall below this standard, many of them are relatively close to the standard. While this is similar for RN and LPN staff combined, in which most facilities fall within about 10-20% of the proposed minimum standard, facilities are frequently farther below the RN staffing levels (21% of facilities are more than 30% below the minimum RN staffing and 50% of facilities are more than 30% below the preferred minimum RN staffing levels).

Table 12.2 Minimum and preferred minimum staffing levels associated with improved quality and the percentage of facilities below these levels

<u>Minimum</u>		Percentage of Facilities			
		<u>Below</u>	<u>≥10% Below</u>	<u>≥20% Below</u>	<u>≥30% Below</u>
Aide	2.00 hrs/resident day	54%	37%	24%	14%
RN+LPN	0.75 hrs/resident day	23%	15%	9%	5%
RN	0.20 hrs/resident day	31%	29%	25%	21%
<u>Preferred Minimum</u>					
Aide	2.00 hrs/resident day	54%	37%	24%	14%
RN+LPN	1.00 hrs/resident day	56%	45%	30%	17%
RN	0.45 hrs/resident day	67%	61%	56%	50%

Overall, the minimum staffing levels identified by these analyses will require significant change (i.e., greater than a 10% change in staffing) for about one-third of the facilities. The preferred minimum standards would require significant change for about half the facilities. However, these standards should be applied based on facility case mix, with the highest staffing levels required in facilities that treat patients with the most complex care needs and lower staffing requirements for facilities that treat patients with lesser care needs. To determine appropriate staffing levels for different categories of facilities, a staffing level analysis such as the one conducted across all facilities needs to be conducted for categories of facilities defined by case mix.

12.4 What Attributes of Case Mix Are Important to Take Into Consideration in Determining Staffing Levels?

Staffing levels are expected to differ among facilities based upon patient needs and risks for quality problems. Throughout our analyses we adjusted for case mix characteristics that were associated with care needs and risk for quality problems using multivariate methods. While this is not practical from a policy perspective, where stratifying (or categorizing) facilities according to case mix will be required, it enabled us to both identify important case mix characteristics and to determine staffing relationships with quality across all facilities. Without adequate control for case mix, facilities admitting patients at the highest risk for quality problems, where staffing is typically greater, are likely to have a higher rate of quality problems; therefore, higher staffing levels can appear to be associated with worse quality.

We measured case mix by examining the prevalence of certain characteristics among residents recently admitted to a facility, and others among residents residing in the facility for at least 90 days. The admission characteristics were obtained from Medicare claims data pertaining to Medicare admissions,

whereas the long-stay case mix indicators were obtained from the MDS. Resident-level values were aggregated to the facility level to yield percentages.

Table 12.3 contains the case mix characteristics that were used in the multivariate models to define staffing ratios. They are divided into admission case mix indicators corresponding to the hospitalization quality measures and the long-stay case mix indicators corresponding to the long-stay quality measures from Table 12.1. The admission case mix indicators are diagnoses that were found on the hospital claim, the SF. claim, or a previous hospital or SF. claim occurring in the prior six months. The reason for using this relatively liberal criterion is that the covariates are all chronic conditions that would persist over time but are frequently under-reported during episodes with different primary diagnoses. While these case mix indicators were chosen based upon clinical associations with avoidable hospitalizations for the specific quality measures, in sum they represent a cross-cutting set of diagnoses that pertain to multiple quality measures relating to potentially avoidable hospitalizations.

Table 12.3 Case mix characteristics that were relevant to defining staffing ratios

Admission case mix indicators

- Dysphagia (swallowing difficulty)
- CHF
- Renal failure
- Cancer
- Chronic respiratory problems
- Hypertension
- HIV
- Comatose
- Diabetes mellitus

Long-stay case mix indicators

- Body mass index < 21
- Functional disability (Barthel Index < 25)
- Cognitive impairment (Cognitive Performance Scale \leq 4)
- Visual impairment
- Psychiatric diagnoses (e.g., depression, psychoses)

The long-stay case mix indicators include the major types of disability and chronic care problems that nursing home residents suffer. Body Mass Index less than 21 is associated with nutritional deficiencies, placing an older person at substantially higher risk for morbidity and mortality. While some may argue that Body Mass Index is affected by the facility's ability to treat nutritional problems, we maintain that Body Mass Index itself frequently reflects underlying chronic illnesses and disabilities with which a nursing home is confronted. Weight loss among individuals with low Body Mass Index, however, is an important quality measure. Functional disability based upon the Barthel Index includes the following activities of daily living (ADLs): eating, transferring, grooming, toileting, bathing, walking, dressing, bowel continence, and bladder continence (Wade & Collin, 1988; Mahone & Barthel, 1965). We chose this as a case mix indicator because it broadly represents function, weights the functions based on consensus, and has been validated and used widely, including a strong correlation with living

independently in the community. Residents scoring less than 25 (out of 90) on the Barthel Index exhibit substantial disability. The Cognitive Performance Scale is a validated measure of cognitive function based on the MDS (Morris et al., 1994; Hartmaier et al., 1995). A score of 4 or more represents significant dementia. Visual impairment is an important sensory deficit. Psychiatric diagnoses, although treatable, do not always respond effectively to treatment and can influence all aspects of nursing home care.

Recognizing the multiplicity of important case mix indicators for determining staffing levels, we developed separate admission case mix and long-stay case mix indices to be used for categorizing facilities. Our goal was to categorize facilities according to risk of potentially avoidable quality problems reflecting differences in resident care needs. For regulatory purposes, facilities could be classified using a case mix index based on claims data for admissions and based on MDS data for long-stay residents. The admission case mix index used all nine of the case mix indicators, assigning a weight of two to the first five because they were more prevalent and more strongly related to quality. Using this weighted case mix index, facilities across all three states were classified into three groups. In the lowest case mix group, 24% of facilities had a high hospitalization rate (worst decile) for at least one hospitalization measure. In the middle case mix group, 41% of facilities had a high hospitalization rate for at least one hospitalization measure, and in the highest case mix group 57% of facilities had a higher hospitalization rate for at least one measure. Thus, the index appropriately separated facilities into case mix categories according to risk for hospitalization.

A case mix index for long-term residents was created using Body Mass Index, functional disability, and cognition, with the first two measures assigned a weight of two. The resulting case mix index divided New York facilities into two groups. In the lowest case mix group, 8% of facilities had a high rate of incident pressure ulcers (i.e., worst decile), whereas in the highest case mix group, 35% of facilities had a high rate of incident pressure ulcers. Thus, the index appropriately separated facilities into case mix categories according to risk for incident pressure ulcers and resisting care.

While an attempt could be made to combine these two indices, facilities or units could be assessed on the admission case mix index separately from the long-term resident index. Regardless of the exact procedure used to classify facilities into case mix categories, our analyses unequivocally showed the importance of case mix in determining staffing needs. Thus, some method should be used to categorize facilities according to case mix for developing and applying staffing standards.

12.5 How Might Case Mix Be Taken Into Consideration When Applying Staffing Requirements?

Complete development and testing of a case mix index and staffing levels within case mix categories is beyond the scope of this phase of the project. For that activity, data from more states will be required, more quality measures will need to be examined, and case mix indices will be refined. However, in a

circumscribed analysis using New York 1997 data, we applied the previously discussed case mix indices and examined staffing thresholds within case mix categories focusing on certain quality measures. The purpose of these analyses was to illustrate how staffing levels might be operationalized nationally.

As presented in Table 12.4, we divided facilities into three categories according to the admission case mix index: low, moderate, and high. Within each of these three categories, we used the same analytic method as before to determine staffing thresholds below which facilities were at greater risk for quality problems. The only difference between these analyses and the previous analyses is that within these case mix categories we made no effort to risk adjust for case mix characteristics, assuming that the categories took case mix into consideration. For the admission sample, the quality measure was whether or not the facility was in the worst decile for one or more hospital transfer measures.

For the admission sample, the only threshold we identified for nurse's aide staffing was 2.0 hours per resident day, which applied to all case mix categories and was the most significant threshold that emerged for the hospital transfer quality measures. The values reported in parentheses below the staffing level refer to the percentage of facilities that fall below and above the staffing level that have one or more hospital transfer quality measures in the worst decile. Thus in the low case mix category, 22% of facilities with less than 2.0 hours per resident day of nurse's aide time were in the lowest decile for at least one quality measure, whereas only 2% of facilities above the 2.0 hours per day threshold had one or more measures in the lowest decile. Moving to the moderate and high case mix categories, the proportion of facilities with a quality measure in the lowest decile when aide staffing is less than 2.0 hours per resident day increases substantially. The percentage also increases among facilities with greater than 2.0 hours per day of nurse's aide time due to increased risk.

For RN and LPN combined, the minimum and preferred minimum staffing levels increase from the low to the moderate to the high case mix categories and between the minimum and preferred minimum levels within each case mix category. In all cases these staffing levels are associated with improved quality of care as indicated by the hospital transfer differences between those below and above each threshold. While the minimum staffing levels reduce the likelihood the facility will be in the worst quality decile for at least one hospital transfer quality measure, the results pertaining to the preferred minimum level suggest that only very small percentages of facilities in each case mix category would have any quality problems if these are followed (2%, 6%, and 4%, respectively). The RN staffing levels follow the same pattern as the combined RN and LPN levels across the three case mix categories, but there were no separate minimum and preferred minimum levels in the moderate and high categories for RNs.

For long-stay nursing home residents, we developed the long-stay case mix index. This index divided facilities into only two case mix groups. For the long-stay sample, the quality measure we used was whether or not the facility was in the worst decile for incident pressure ulcers. Staffing levels for pressure ulcer incidence were only identifiable for the higher case mix category, which included those

facilities with the greatest prevalence of functional disability, nutritional problems, and confusion. In the low case mix category, staffing levels did not discriminate between facilities with high and low pressure ulcer rates. Within the high category, however, ratios were found for nurse's aide staff, RN and LPN staff, and RN staff below which facilities were more likely to have a high rate of incident pressure ulcers (Table 12.4). Facilities with nurse's aide staffing below 1.9 hours per resident day were in the worst quality decile for incident pressure ulcers in 46% of the cases as opposed to 12% of those with aide staffing above 1.9 hours per resident day. These staffing levels for pressure ulcer incidence in the high case mix category are very similar to those for the admission case mix index. Thus, if a facility falls in this high category, either for long-stay residents or for Medicare admissions, the staffing

Table 12.4 Staffing levels and effect on quality indicators for illustrative facility case mix categories based on New York 1997 data

	<u>Case Mix Indices</u>					
	<u>Low</u>		<u>Moderate</u>		<u>High</u>	
	<u>Minimum</u>	<u>Preferred Minimum</u>	<u>Minimum</u>	<u>Preferred Minimum</u>	<u>Minimum</u>	<u>Preferred Minimum</u>
<u>Admission Sample</u>						
Aide staffing (\$1 Hospitalization)	2.0 (22/2)	2.0 (22/2)	2.0 (44/14)	2.0 (44/14)	2.0 (70/29)	2.0 (70/29)
RN+LPN staffing (\$1 Hospitalization)	0.50 (50/31)	0.65 (31/2)	0.55 (36/21)	0.80 (21/6)	0.70 (69/37)	1.0 (37/4)
RN staffing (\$1 Hospitalization)	0.15 (33/17)	0.30 (17/4)	0.45 (30/11)	0.45 (30/11)	0.55 (50/36)	0.55 (50/36)
<u>Long-Stay Sample</u>						
Aide staffing (Pressure ulcer)	---	---	---	---	1.9 (46/12)	1.9 (46/12)
RN+LPN staffing (Pressure ulcer)	---	---	---	---	0.85 (26/11)	0.85 (26/11)
RN staffing (Pressure ulcer)	---	---	---	---	0.57 (24/10)	0.57 (24/10)

requirements would be very similar. The reason that staffing levels were not found for the lower case mix categories may be that incident pressure ulcers are a less critical problem in facilities with lower-risk residents who have less functional disability, dementia, and malnutrition.

While this illustration does not answer all questions about how empirically-derived staffing levels may be applied, it does demonstrate the feasibility of such an approach. Further, it demonstrates the importance of taking facility case mix into consideration when setting staffing standards because staffing levels for at least some types of staff are case mix dependent. These analyses also reinforce the relationships between staffing levels and quality that were presented earlier.

12.6 Conclusion

The existence of a relationship between staffing and quality of care in nursing homes, while inherently logical, is difficult to demonstrate empirically because of complexities in measuring quality, the limitations of staffing information, and the confounding that occurs with facility case mix. An even greater challenge is to empirically determine staffing levels that are important to achieve in order to assure adequate quality of care across an array of quality measures. Facility case mix confounds these determinations. However, if we intend to apply staffing requirements, a strategy is required for taking case mix into consideration. In the analyses described in Chapters 9 through 12, we were able to address all of these issues.

The evidence from these analyses for an association between low staffing levels and the likelihood of quality problems across an array of measures and for different types of staff was compelling. Staffing thresholds were identified for RN staff, RN and LPN staff combined (licensed staff), and certified nurse's aide staff below which facilities were at higher risk for quality problems such as hospitalization for avoidable causes, incident events such as pressure sores and significant weight loss, and lack of improvement in function and resisting care. These staffing thresholds were relatively consistent across measures, suggesting the following absolute minimum staffing levels: 2.0 hours per resident day of nurse's aide time, 0.75 hours per resident day of licensed time (RN + LPN), and 0.2 hours per resident day of RN time. While these minimum staffing levels are not met for nurse's aides in 54% of the facilities, for licensed staff in 23% of the facilities, and for RN staff in 31% of the facilities, most of the facilities that are below the minimum licensed and nurse's aide staff levels are less than 20% below the level. Preferred minimum levels, below which facilities were not at increased risk for quality problems in any of the domains tested, were also identified. These preferred minimums were 2.0 hours per resident day for nurse's aides, 1.0 hour per resident day for licensed staff, and 0.45 hours per resident day for RN staff.

While these minimum staffing levels are adjusted for case mix across all facilities, it would not be appropriate to apply them to individual facilities without considering individual facility case mix. That is, facilities treating patients with fewer impairments and risks do not require the same level of staffing as facilities where there is a higher prevalence of impairment and complex care needs. Thus, we would expect minimum staffing levels to differ based on facility case mix. However, no existing case mix index has been shown to classify facilities with respect to staffing minimums. To illustrate how this might be accomplished, we developed case mix indices and categorized facilities in New York into three case mix categories to determine whether staffing thresholds differed by case mix category. We found that nurse's aide staffing thresholds were consistent across case mix categories at about 2.0 hours per resident day. As we would expect, however, licensed and RN staffing levels required to maintain quality of care increased as case mix intensity increased.

While the case mix indices developed for this project may not be the ones ultimately applied, they

demonstrate the utility of categorizing facilities according to case mix and then applying staffing levels. These indices are based on a combination of claims data and MDS data that could be used to profile facilities annually and categorize them for the purposes of assessing staffing levels. To operationalize such an approach, additional analyses are required to refine case mix indices and methods for categorizing facilities, test staffing levels in additional states and using additional quality measures, and consider mitigating factors such as staff turnover and staff allocation that might influence the relationship between staffing and outcome. Nevertheless, empirically-derived minimum staffing levels and methods for case mix adjustment are strongly suggested by these analyses.

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